

OBSERVATIONS ON THE LIFE-HISTORY OF A LIOTHEID (*MALLOPHAGA*)
PARASITE OF THE CURLEW (*NUMENIUS ARQUATA* LINN.).

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On 10.x.1910 I shot a common Curlew at Collafirth, Northmaive, Shetland, and examined it for Mallophaga. It was then my custom in dealing with host species to search the plumage of any specimens passing through my hands feather by feather, and to this was due the discovery of a Mallophagan habitat and mode of life which at the time were new to me, and which now, with a wider knowledge of the literature of the group, I find to be apparently almost unnoticed. I had pulled out an old primary when something unusual in the appearance of the barrel or calamus caught my eye. Normally the quill in this region shows, when seen by transmitted light, a few more or less oblique septa, the divisions, *i. e.*, between the internal horny caps which together form a structure (called by German writers "die seele"—the soul of the feather), for which there exists no exact term in English.

In the present case, however, the lumen was continuous from the superior down to the inferior umbilicus where, on looking carefully, I noticed one or two small dark masses. As I watched, one of these masses detached itself from the others, and travelled shadow-like up the barrel. That it was an animal of some sort seemed certain, but how it had got inside the feather was puzzling, since no aperture was at first discernible. Later, however, a very small hole was detected—too small, as events proved, for the exit of the creature whose movement I had just watched. On splitting the feather open several examples of a rather large *Colpocephalum*, at various stages of development, were disclosed. Two more feathers in a similar condition were found in the same wing of this bird.

Since discovering this peculiar habit I have never missed an opportunity of examining the plumage of Curlews for the parasite. The percentage of infested birds has not been high, but I have no note of the exact figure. With one exception, when two ♀♀ were taken at large, between the webs of two adjacent flight-feathers, the *Colpocephalum* has occurred in its original habitat within the quill, from half a dozen up to a hundred specimens being present. In the latter case, though there was a small clear space distally, the parasites were tightly packed proximally, and tumbled out in a struggling mass when part of the shaft was excised. Either primary or secondary feathers may be attacked. I have found up to five feathers in one bird tenanted. The effect of this occupation may be noted.

(a) Apertures.—The inhabited quill (fig. 1 a) is pierced by one or more apertures. Commonly one is present which may be too small to permit the egress of the largest of the enclosed parasites. This aperture is regular and approximately circular (fig. 1 b) in outline, but may be irregular and large. It is placed at some point on the proximal third of the rachis, as a rule on the ventral aspect, and pierces the pith. A second aperture, generally larger, is sometimes seen either near the first on the rachis or on the barrel. I have seen at least a third tiny hole in one case, and even more may be expected to occur. Such extra holes are possibly to be explained as of accidental occurrence during the working of the parasite.

(b) Internally the calamus is smooth and “die seele” has been devoured, while distally the pith is consumed for some distance. In an

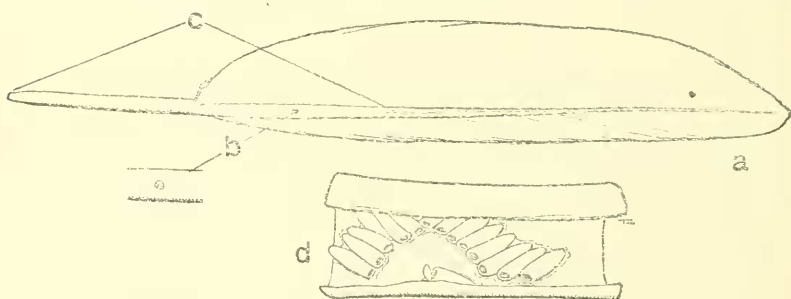


Fig. 1.—a, Flight-feather of Curlew (*Numenius arquata*); b, Aperture made by *Colpocephalum*; c, Calamus and proximal part of rachis; d, Eggs of *Colpocephalum* in situ.

extreme case there may be a continuous passage between the points indicated by the lines from c. in the figure. Sometimes, however, the pith is incompletely removed and merely tunnelled for some distance.

(c) One effect of the occupation of the shaft by the *Colpocephalum* is possibly a retarding of the normal moulting time. The point is put forward more as a suggestion than as an ascertained fact, but occupied feathers sometimes appear conspicuously weathered and pale in a set which has been recently renewed. My knowledge of the moult of the flight-feathers of *Numenius* is, however, quite insufficient to determine whether, in the case referred to, the feathers had persisted beyond their due time, but if future observations should establish what is here tentatively put forward, the importance of the fact in ensuring the survival of the species is considerable.

Turning now to the contents of this unusual habitat one finds:—

(a) Every stage of the *Colpocephalum* may be represented from the egg to fully coloured adults. The eggs for the most part lie side by

side in rows which may be either straight or in short spirals. If one of the eggs at the end of a row is freed by a needle-point from the surface of the calamus the others lift with it, and by the exercise of a little care the whole row can be detached, the eggs being glued together so that when turned over the row appears to be a glistening band. The cement extends as a narrow margin beyond the edge of the band (fig. 1 *d*). I have not observed oviposition by this species, but apparently what happens is that the cement (whose emission takes place at the beginning of the process) runs between the egg-shell and the smooth surface of the barrel, and is not gathered at the posterior (*i. e.*, that remote from the operculum) end of the egg into an anchoring mass. I have, however, seen single eggs, attached like the others by their side to the supporting surface, which showed a distinct knob or amorphous tail posteriorly. I have no note now by me of there being in such cases any reduction in the amount of cement at the margin, though one would expect this to follow.

(*b*) With the eggs are found numerous empty shells from which the operculum is generally pushed completely off. The operculum frequently is seen persistent in recently hatched examples, so that its removal in other cases may be due to the movement of the insects crowded into a narrow space. With the egg-shells are to be found cast-off skins of all stages, and both are frequently devoured—presumably by the parasites themselves, though mites may also be responsible for this.

(*e*) There are also large accumulations of faecal matter in the form of a fine grey sand which may fill the proximal third or more of the calamus.

Putting these observations together one may hypothetically reconstruct in outline the life-history of the parasite. Access to the quill is gained by the *Colpocephalum* boring into the rachis, several specimens using the same hole. Once inside the quill the parasites feed on the pith and “seele,” attain maturity and breed freely. Either through failure of their food supply, or through overcrowding, an exodus is initiated, the original entrance being enlarged or a new hole formed. It is possible, of course, that before any general exodus takes place the adult parasites may have left and returned to their strange habitat many times. The very thorough examination of the plumage of several hosts made, renders this highly improbable. I think it likely, also, that new colonies are initiated, not by adult females, but by immature examples. I have recorded these observations, incomplete as they are, partly because of their—to the possibly prejudiced eye of a student of the

group—intrinsic interest and partly because species with so defined a habitat may, with suitable manipulation, be made to yield further valuable information as to the bionomics of the Mallophaga. One point on which light might be shed may be mentioned. Very extraordinary indeed must be the changes by which the meal of a biting louse becomes physiologically available for its ingester. But ordinarily that meal may, to begin with, be exceedingly complex. A louse in the course of a day may feed on feather fibre, epidermal scales and powder, and even the skin itself if roughened, while blood extravasated in any casual way is greedily devoured. Within the quill, on the other hand, the food supply, once “die seele” has disappeared, is of uniform quality, and I should suggest that comparative analyses of the pith of the rachis and of the grey faecal sand would yield results of interest. The difficulty of course would be to get the material in analysable quantities, but it is not an insurmountable one.

I believe the name of this *Colpocephalum* to be *C. patellatum* Piag.³ (p. 254, pl. x, fig. 8). So far as I am aware, the species has not been recorded since its description by the French author, and this in view of the notes already given is hardly astonishing.

Henry Denny² (p. 207) has recorded the same or similar phenomena in the case of *Colpocephalum flavescens*. His remarks are worth quoting in full: “To the Earl of Derby I am indebted for several examples from the Harpy Eagle (*Harpya destructor*). On the 14th of November, 1837, Mr. Yarrell¹ (p. 127) exhibited, at a meeting of the Zoological Society of London, a quill from the wing of the above bird, which had died while in the menagerie of his lordship at Knowsley, and which was found upon examination to be infested with a great number of a species of *Colpocephalum*. It appeared that these minute creatures had chosen for their place of retreat the hollow of the large quill feathers, which were filled with their exuviae; two circular apertures situated near the base of the quill afforded the animals access to its interior. Another quill, infested with the above, his lordship obligingly forwarded to me, with the following remarks: ‘My superintendent lately found in a young Harpy Eagle, who was not moulting kindly, two feathers, of which the quills when extracted were filled with a substance he could not make out, he opened one and found the whole base of the quill filled with lice, at that time alive, but they soon died; there was at first no apparent opening, but on a close microscopic examination two small holes were observed at the base of the web, since then he has found and extracted four more; in one, besides the lice, observing something to move, he opened it and found a large white maggot.’ From the hundreds

of skins accumulated in one quill, and to whose interior there had been no access but through the small orifices mentioned, it would appear that this species of *Colpocephalum* at least seeks a place of shelter when about to undergo so important a change as the shedding of its entire skin, similar to what we know takes place with Crustaceans." It is evident that in Denny's quill the infestation had been long established—witness the two apertures. The hundreds of skins are easily understood when one remembers that the Harpy Eagle quills are larger than those of the Curlew, while *C. flavescens* is a much smaller species than that of which I have been speaking. The fact that both parasites are at present placed in *Colpocephalum* should not be over stressed, for that genus needs subdividing, and when that is done the two will certainly be apart.

The note that the Harpy Eagle had been moulting badly, should be compared with what has been said above. As to what portion of the life-history of the parasite is passed in its retreat Denny is cautious. He thinks it is used at least for the ecydses (*cf. supra*), but does not discuss the possibility of a longer part of the life-cycle being spent in this curious habitat. I am not aware of any subsequently published paper bearing on Denny's observations nor, after drawing the attention of various students of the Mallophaga to the passage quoted, have more recent instances of similar phenomena, been brought to my notice. During the past twelve years I have only once or twice found flight feathers of raptorial hosts tenanted by *Colpocephalum*. The habitat is not confined to parasites of Old World forms, for Mr. G. E. Bodkin, 17.v.1915, sent to the Imperial Bureau of Entomology, London, a feather of *Rostrhamus sociabilis*—a small Kite—from Turkeyen, British Guiana, affected in this way. Such cases are probably much commoner than the paucity of records might lead one to suppose, and it is much to be desired that the phenomena outlined above should have more attention given to them, in order that their precise rôle in the life-history of the species may be properly understood.

References.

- ¹ YARRELL (W.). Proc. Zool. Soc. Lond., 14th Nov. 1837.
- ² DENNY (H.). Monographia Anoplurorum Britanniae, London, 1842.
- ³ PIAGET (E.). Tidj. v. Ent. xxxiii. 1888.

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